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ABSTRACT

This booklet on ecosystems is one of a series in environmental education for grades K-12. Activities in this booklet are concerned with the complexity of ecosystems, energy forms and transfer in ecosystems, and stress capacity of ecosystems. Six basic concepts are listed, along with behavioral objectives, subject areas, key words, and definitions for each. Three activity options develop the basic concepts. Information for these activities includes materials and resources, procedures, discussion questions, further activities, and sample worksheets. The activities are interdisciplinary and designed for students in grades 6-8. (MA)

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ECOSYSTEMS

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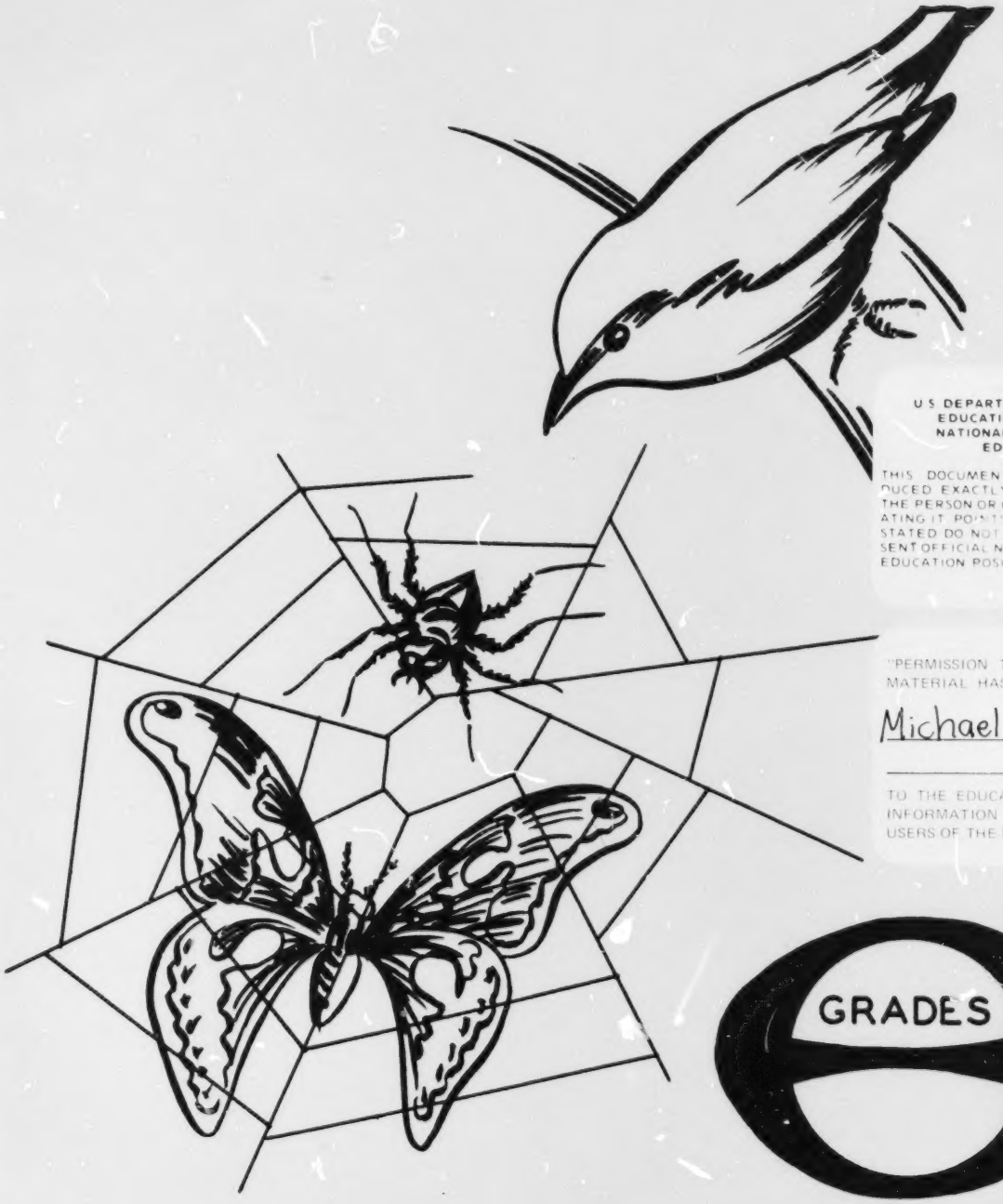

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GRADES

ENVIRONMENTAL EDUCATION

VALUES FOR THE FUTURE

ANTIOCH COMMUNITY SCHOOL DISTRICT 34

TITLE IVC ESEA

SE 023 455

TABLE OF CONTENTS

Page

Explanation of Concept area 1

Synopsis

Ecosystems 10: At the completion of this unit the student will be able to explain how the degree of complexity of an ecosystem is measured by the number of its component parts and the number of interactions between the parts.

Option 1 - Students study two ecosystems closely - an anthill and a classroom - and make comparisons. .. 3
Option 2 - Students study the terms population and community through the use of a filmstrip. .. 5
Option 3 - Students study community interactions and chart interactions within their own community. .. 6

Ecosystems 11: At the completion of this unit the student will be able to recognize some of the basic laws which govern the actions of the components of our ecosystem.

Option 1 - The necessity of laws in general and laws within the ecosystem in particular is scrutinized by the students. .. 9
Option 2 - The film, The Lorax, is viewed and students discuss the implications of the film. .. 11
Option 3 - Students prepare short three-act plays to depict the elements necessary to sustain life. .. 13

Ecosystems 12: At the completion of this unit the student will be able to explain how some of the sun's energy has been stored as coal, peat, petroleum, natural gas, and other fossil fuels.

Option 1 - Students diagram different cycles and study the sun's role in each. .. 18
Option 2 - Students design and draw/build a Rube-Goldberg machine. .. 20
Option 3 - Students trace the manufacturing of various products back to the sun. . 22

Ecosystems 13: At the completion of this unit the student will be able to explain how energy is lost, mainly as heat, with each transfer of energy within an ecosystem.

Option 1 - Students study the heat given off in respiration of yeast cells. .. 24
Option 2 - Students study the energy budget as measured by caloric intake and physical exertion. .. 25
Option 3 - Students investigate the changes made to increase the efficiency of the modern "farm factory". .. 27

Table of Contents

Ecosystems 14: At the completion of this unit the student will be able to explain why the amount of energy necessary to maintain an ecosystem is directly related to the amount of stress placed on the system.

Option 1 - A series of classroom stresses is placed upon students to see what reactions they will have. .. 32
Option 2 - Students play a game "Toothpick Birds" which points out how the need for food places a stress on a system. .. 33
Option 3 - "Predator-Prey Tag" is a game which points out survival of the fittest. .. 34

Ecosystems 15: At the completion of this unit the student will be able to explain how a pollutant affects a natural cycle.

Option 1 - Students view a film showing man's harmful effect on nature through pollution. .. 37
Option 2 - Students measure BOD and DO content of water samples. .. 38
Option 3 - A film and discussion point out how chemicals can be pollutants in the human system. .. 40

EXPLANATION OF CONCEPT AREA

ECOSYSTEMS - In any program of environmental education we must include material to help students develop a clearer understanding of basic ecological principles.

We begin this process by defining the basic components of a simple system, its energy source, definition, and basic relationships.

We then build upon this to define place, energy, interactions, and the problems of pollution of ecosystems.

In grades 6-8 we focus on the complexity of ecosystems, energy forms and transfer in ecosystems, and the stress capacity of ecosystems.

In high school the students use their previous experiences to further explore the structure of ecosystems, their dynamic nature, and the interactions between humans and ecosystems.

BEHAVIORAL OBJECTIVE:

At the completion of this unit the student will be able to explain how the degree of complexity of an ecosystem is measured by the number of its component parts and the number of interactions between the parts.

SUBJECT AREAS:

Science, Social Studies

KEY WORDS AND DEFINITIONS:

Population - any group of like organisms living in a certain area

Community - a group of populations together

Environment - the total of all surrounding conditions of an organism

OPTION #1

MATERIALS AND RESOURCES

Ecosystem observation chart
Outdoor area to observe ecosystems

PROCEDURE:

1. Explain the word ECOSYSTEM by saying it is a group of plants and animals that eat other living things or take living or non-living things from the soil in order to live and when they die the minerals from their bodies return to the soil.

2. Observe an ecosystem outdoors. For example: Locate several anthills and have the students observe the number of ants entering and leaving the hill. Have them record that data. Also have students record anything the arts might be carrying.

3. Have the students observe what others do during a recess time or during a a work time in the classroom (what games were played, what work was done, materials used, etc.). Later compare the ants to the people.

4. Other ecosystems may be used, the idea being that the students use the questions below as a guideline for whatever ecosystem they are observing. The chart on the following page can be changed accordingly.

5. Chart all observations.

DISCUSSION QUESTIONS

1. Why are the particular animals in the ecosystem the kind and size they are? Example: Why do ants live in small anthills?

2. What can these animals do? Why? (Does the body of the animal determine what they can do?)

3. Why are the plants in the ecosystem the kind and size that they are? (Why don't we find giant ferns living here?)

4. Look at the list of classroom activities. What things were the children able to do?

5. Why were they able to do these things? What did they use to do what they did?

6. Why do we have some of these items in our classroom? (chalk, books, blackboards, pencils, etc.)

7. Do all other classrooms in the school have the same materials?

8. Which classrooms have items similar to those found in yours? Why? Can children in those classrooms do some of the same things you do? Why?

9. Which classrooms have very different items? Why are these items found in their rooms?

3

OPTION #1 ECOSYSTEM OBSERVATION CHART

ECOSYSTEM OBSERVED _____

Animals	How many	Characteristics (color, size, etc.)

Plants	How many	Characteristics:

Other	How many	Characteristics:

Interactions

List how the elements of the ecosystem affect each other:

1.
2.
3.
4.

OPTION #2

MATERIALS AND RESOURCES

A Visit to a Garden
Green Plants in a Community
Animals in a Community
Living Things form a Community
} all SVE filmstrips, available E^2 Office

PROCEDURE:

1. View one or all of the filmstrips listed above.
2. Discuss the vocabulary list below.
3. Identify members of each community.
4. For homework have the students list things found in their garden, yard, lot near their home, etc.

DISCUSSION QUESTIONS

1. What do we need to have a population?
2. What things belong in a population?
3. What do we need to have a community?
4. What do plants need?
5. What is a food supply?
6. Why do plants need flowers?
7. How do you cooperate with others?
8. What does environment mean to you?
9. Name some of the things we need in the environment.
10. What animals were found in the garden? Why?
11. What kinds of animal populations are there in your home, your backyard, and your neighborhood?

VOCABULARY LIST

POPULATION	NATURE	COOPERATION
COMMUNITY	FOOD SUPPLY	

5

OPTION #3

MATERIALS AND RESOURCES

Community Murals and Cassettes
Community Study Prints
Community Food Chains and Food Webs
} available E^2 Office

PROCEDURE:

1. Using the study prints illustrate a few of the members that make up the various communities.

2. Divide the class into four groups and using the community interactions form (included) ask them to identify the interactions that take place in each community by filling in the box with member names and connecting all interacting members.

3. When they have completed their forms have them explain to the others how their ecosystem members interact.

DISCUSSION QUESTIONS

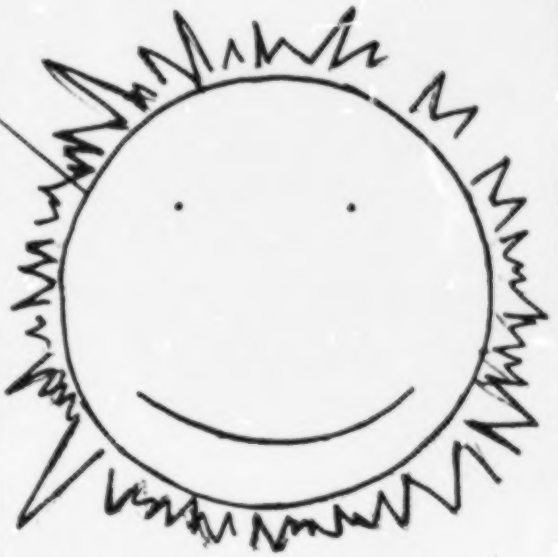
1. What do we mean by complex and simple?

2. If an ecosystem has two parts, how many interactions are possible? Three parts? Four parts? Five parts?

3. Does every part of an ecosystem interact with every other part? Explain.

4. How is your family like an ecosystem? Is your family complex?

COMMUNITY INTERACTIONS FOR _____



7

BEHAVIORAL OBJECTIVE:

At the completion of this unit the student will be able to recognize some of the basic laws which govern the actions of the components of our ecosystem.

SUBJECT AREAS:

Science, Language Arts, Social Studies

KEY WORDS AND DEFINITIONS:

Ecosystem - a group of interacting plants and animals as they exist in nature.

OPTION #1 - no specific materials

PROCEDURE:

1. Write the following concept on the blackboard - NATURAL LAW.

2. Divide the class in half. Each individual in one half should list as many words as they can that might be used in the understanding of the word NATURAL. The other half should list as many words as they can that might be used in the understanding of the word LAW.

3. When they are completed ask volunteers to call out some of the words used for NATURAL and some words used for LAW. List these words under part of the larger phrase.

NATURAL	LAW
trees	right
water	wrong
fish	police
people	courts
etc.	etc.

4. Now ask each student, based upon the words lsited, to write a definition of NATURAL LAW.

5. List a few definitions on the blackboard that have been volunteered from the class.

6. Ask the class if any small changes need to be made to make the definitions more accurate. NOTE: Coax them, if needed, to somewhat accurately define the phrase.

7. Ask eight students to stand up and explain that one student is a fish, one a frog, one the water, one the Sun, one the clouds, one a fly, one algae, and one mankind.

8. Ask the rest of the class to participate by taking each one of these eight things and describe how they would follow natural law and what would happen if one would "break" the law.

DISCUSSION QUESTIONS

1. Are there a set of natural laws we all must follow?

2. Can you think of any living thing that does not follow a natural law?

3. How are natural laws broken?

4. What, in the environment, acts as a policeman to enforce these laws?

5. What usually happens to those that break natural laws?

6. How have natural laws been created?

OPTION #1 cont.

7. Does man have natural laws that govern him?
8. How does man break natural laws?
9. How does man often try to act as the policeman for natural laws?

OPTION #2

MATERIALS AND RESOURCES

The Lorax, film from E^2 Office

PROCEDURE:

1. Show the film.
2. Have the students write answers to the four introductory questions below.
3. Discuss the remaining questions, relating them to real-life situations.
4. After class discussion, have the students re-answer.
5. Discuss and compare students' answers to introductory questions on the basis of the following:

   a. what the answers were
   b. why they changed their answers

INTRODUCTORY QUESTIONS

1. Why did Onceler start making Thneeds? (public demand)
2. Who made it possible for the Onceler's idea to get out of hand? (the buying public)
3. What were the effects, good and bad, of Onceler's factory?
4. Who does the Lorax symbolize?

DISCUSSION QUESTIONS

1. Why did Onceler say, "What are you doing in my tree stump?" Who owns the trees?
2. "I chopped down one tree. I'm doing no harm." When does harm start?
3. What did the Onceler family bring with them when they came? (litter, ideas, machinery, progress)
4. What is the Onceler's main concern? (money)
5. Why did Onceler build the four lane highway?
6. What was Onceler most proud of? (profit and speed of production)
7. What happened when the town grew?
8. How was advertising handled in the film? (signs on all the trucks, many billboards, songs, high degree of "brain washing")

//

Option #2 cont.

9. What about the sanitation truck dumping garbage into the lake and having the sign "Sanitation is beautiful" on its side? What does this say about people in general?

10. What was the celebration for?

11. Why was Onceler so honored? (he came in a cart and built an empire - Horatio Alger belief, his "sacred mission")

12. What did the Onceler think of the Lorax? (He was a nut, nature boy.)

13. Onceler often sympathized with Lorax. What made him change his mind? (If I don't do it, someone else will. Profit)

14. "Progress must rule." What does this mean?

15. By this time to shut down would ruin many people. Why did Lorax sympathize with Onceler?

16. Who does Onceler speak for? (mankind and human opportunity)

17. What did Onceler's empire depend upon? (trees)

18. What happened when the trees were all gone? What was left?

19. When did Onceler realize what he was actually doing?

20. When did Onceler decide to do something about it?

21. What should "somebody ought"?

22. How could the outcome have been avoided?

23. What had to be changed?

24. When would the change have to begin?

25. What actually happened to the animals the Lorax sent off?

OPTION #3

MATERIALS AND RESOURCES

12 shoeboxes or like containers
Green, red, blue, yellow paper and/or markers
12 cotton balls and tape
Natural environment

PROCEDURE: This activity is totally teacher directed. Please read the procedure carefully and make certain you understand your role in the play. See additional notes throughout the option.

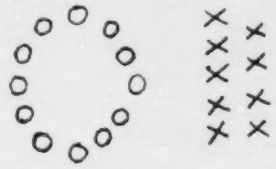
"Life's Community"

1. Before class the teacher should place a handful of dirt and a vial of water in each shoebox.

2. Choose twelve students to be the actors of the play. The others will be the audience.

3. Explain the actors are going to produce a three-act play about the necessities of life.

4. Have the actors sit in a circle facing outward and have the audience sit to one side as sketched in the diagram below.



5. Give the actors their shoebox and place it in front of them.

6. Explain the contents of the box and open one.* "Living things need but a few necessities to sustain life. One thing they need is the earth (show dirt). Another is water (show water). Another is the sun (point out that every time the box is open, sunlight enters). Finally (take a deep breath) the air around us."

7. Explain to the students that by using these four things - earth, water, sun, and air - the actors will tell the story of "Life's Community".

ACT I

8. Tell them that Act I is about to begin. Instruct each of the actors to go out into the environment to find their magic leaf. Give them about one minute.

9. When the actors return have them sit in the circle again, facing outward, with the box in front of them.

10. Instruct the actors that with the contents of the box, air, sunlight, dirt, and water, they should individually tell the story of their magic leaf.

*You may find the shoebox too cumbersome for class work. Therefore, a series of symbolic pictures, one for each element may suffice. For example, arms stretched toward the sky may symbolize the sun.

OPTION #3 cont.

11. The audience should sit around the actor's circle for a one-on-one situation as sketched below:

12. The actors tell the story of their leaf to one or two members of the audience.

13. When everyone has completed his story, instruct the audience to applaud loudly.

ACT II

14. Have the actors stand up. Tape one cotton ball on each actor to simulate a rabbit's cottontail. "Now you are ready to tell the story of the rabbit. Using all the materials you have been given plus the leaf and anything else you can find in the environment, tell the story of the rabbit." Have the actors go out and find items that will help them to tell the story. Encourage creativity.

    NOTE: To keep audience busy, generate discussion on what they think is happening. What might the actors bring back?

15. When the actors return, have them sit in their circle facing outward and have the audience sit in front of them as they did for Act 1.

16. Tell the audience, "The curtain is rising", and have the actors tell the story of the rabbit.

17. When each has finished with his story, the audience shows their approval by applauding.

ACT III

18. Tell the actors they are now going to tell the story of a <u>person</u> using all the things in the box plus all the things they have gathered. Make certain the actors are using the things in the box plus things gathered for Act II. "Actors, go out into the environment to find things that will help you tell the story of a person."*

*Although many things have happened in this act, one of the best results obtained was to instruct the actors, without the knowledge of the audience, to find as much litter as possible to tell the story of man. This has a dramatic effect. You can illustrate the fundamental concept of "all things are dependent and interrelated" but also man's destruction of those things on which he depends.

OPTION #3 cont.

19. The students return and follow the same procedure as in Act I and Act II.

20. To help tie up the concept presented, have the actors divide up into three groups, four in a group.*

21. Tell each group you are now going to assign roles for the group discussion. "If I mark you with red or give you a red card, you will be the sun of your group. You must explain to the other group members why you are the most important thing for life. If I mark you with green or give you a green card, you are the earth and must explain to the group why you are the most important thing for life." Continue for each color so each group has earth, sun, air, and water, all of which are arguing why they are the most important.

22. As discussion begins invite the audience to move about freely from group to group listening to arguments and participating if they wish.

    The discussion should illustrate the interdependence of all living things. Also, that the four components are all equally important.

DISCUSSION QUESTIONS

1. Does an ecosystem need a dependence on one thing or another?
2. What is the importance of the leaf? Rabbit? Man?
3. What would happen if there was a breakdown of the ecosystem?
4. What effect can each of us have on our ecosystem?
5. How does a tree fit into man's ecosystem?
6. Do animals depend upon man?
7. Can man separate himself from the eath in a way that would end his dependency on other forms of life?
8. How is death a part of the life cycle?

*You may wish to end the lesson at this point by a simple summation of each act and how they interrelate to each other. One excellent way to do this is to read selected passages from "A Letter to the President" by Chief Seathl, chief of the Washington tribe. Although written over 150 years ago, it speaks clearly of man's dependencies on nature and his blind destruction of it.

A Letter to the President:

The Great Chief in Washington sends word that he wishes to buy our land. The Great Chief also sends us words of friendship and good will. This is kind of him, since we know that he has little need of our friendship in return. But we will consider your offer, for we know if we do not do so, the white man may come with guns and take our land. What Chief Seathl says, the Great Chief in Washington can count on as truly as our white brothers can count on the return of the seasons. My words are like the stars - they do not set.

How can you buy or sell the sky - the warmth of the land? The idea is strange to us. Yet we do not own the freshness of the air or the sparkle of the water. How can you buy them from us? We will decide in our time. Every part of this earth is sacred to my people. Every shining pine needle, every sandy shore, every mist in the dark woods, every clearing and humming insect is holy in the memory and experience of my people.

We know that the white man does not understand our ways. One portion of the land is the same to him as the next, for he is a stranger who comes in the night and takes from the land whatever he needs. The earth is not his brother, but his enemy, and when he has conquered it, he moves on. He leaves his fathers' graves behind and he does not care. He kidnaps the earth from his children. He does not care. His fathers' graves and his children's birthright are forgotten. His appetite will devour the earth and leave behind only a desert. The sight of your cities pains the eyes of the redman. But perhaps it is because the redman is a savage and does not understand.

There is no quiet place in the white man's cities. No place to hear the leaves of spring or the rustle of insect wings. But perhaps I am a savage and do not understand - the clatter only seems to insult the ears. And what is there to life if a man cannot hear the lovely cry of the whippoorwill or the arguments of the frogs around a pond at night? The Indian prefers the soft sound of the wind darting over the face of the pond, and the smell of the wind itself cleansed by a mid-day rain, or scented with a pine. The air is precious to the redman. For all things share the same breath - the beasts, the trees, the man. The white man does not seem to notice the air he breathes. Like a man dying for many days, he is numb to the smell.

If I decide to accept, I will make one condition. The white man must treat the beasts of this land as his brothers. I am a savage and I do not understand any other way. I have seen a thousand rotting buffaloes on the prairie, left by the white man who shot them from a passing train. I am a savage and I do not understand how the smoking iron horse can be more important than the buffalo that we kill only to stay alive. What is man without the beasts? If all the beasts were gone, men would die from great loneliness of spirit, for whatever happens to the beasts also happens to the man. All things are connected. Whatever befalls the earth befalls the sons of the earth.

This is a letter written to the President of the United States in 1855 by Chief Seathl (Seattle) of the Suwanish tribe of the state of Washington, regarding the proposed purchase of the tribe's land.

Taken from <u>The Ecologist</u>, January, 1975, p. 31.

BEHAVIORAL OBJECTIVE:

At the completion of this unit the student will be able to explain how some of the sun's energy has been stored as coal, peat, petroleum, natural gas, and other fossil fuels.

SUBJECT AREAS:

Science, Social Studies, Arts and Crafts, Language Arts

KEY WORDS AND DEFINITIONS:

Cycle - A continuing series in which each event causes another to happen up to the final event which causes the first to recur

OPTION #1

RESOURCES AND MATERIALS

Technology: Promises and Problems, Allyn and Bacon, Inc., 1972
Posterboard and markers
Art materials
Science reference books

PROCEDURE:

1. Discuss energy chains and cycles - see diagram.
2. Be certain that the students understand that the sun is the source of all energy.
3. Divide the entire class into groups to choose or be assigned one of the following topics:

nutrient cycle	water cycle
nitrogen cycle	carbon cycle
radioactive materials cycle	food chain(s)

4. Students should research and diagram or chart the given cycle.
5. Each group should prepare to report their findings to the class and also prepare to explain their chart or diagram.
6. Discussion should follow on various examples of how we can trace everything back to the sun's energy.

DISCUSSION QUESTIONS

1. What is the sun's role in each cycle?
2. What are the various forms of energy?
3. Trace these forms of energy back to the sun.
4. Trace your own energy back to the sun.
5. What is the longest chain you can come up with? Is there a limit?
6. What would happen without the sun and how fast?
7. Is energy always in the same form? Why or why not?

OPTION #1

THE FOOD CHAIN IN A RIVER MARSH

1. Sun and minerals grow plants and flowers.

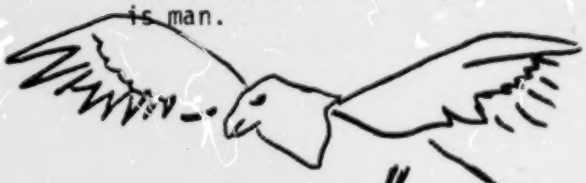
2. Butterfly sips nectar from the flower.

3. Dragonfly eats butterfly.

4. Frog eats dragonfly.

5. Snake eats frog.

6. Hawk eats snake. Food chain ends here. Hawk's only predator is man.



OPTION # 2

MATERIALS AND RESOURCES

A transparency of a Rube-Goldberg machine (if possible, build one)
Art materials
Building materials - These are dependent upon the type of machine and project the students wish to build.

PROCEDURE:

1. Be certain the students understand that the Sun is the source of all energy.

2. Explain and give examples of what a Rube-Goldberg machine is. See attached example.

3. Students are to design a Rube-Goldberg machine with one qualification. The SUN must be the initial source of energy.

4. Students may either draw or build their machine dependent upon their ability level and/or the desire of the teacher.

DISCUSSION QUESTIONS

1. Does your machine have the Sun as its source?

2. How efficient is your machine?

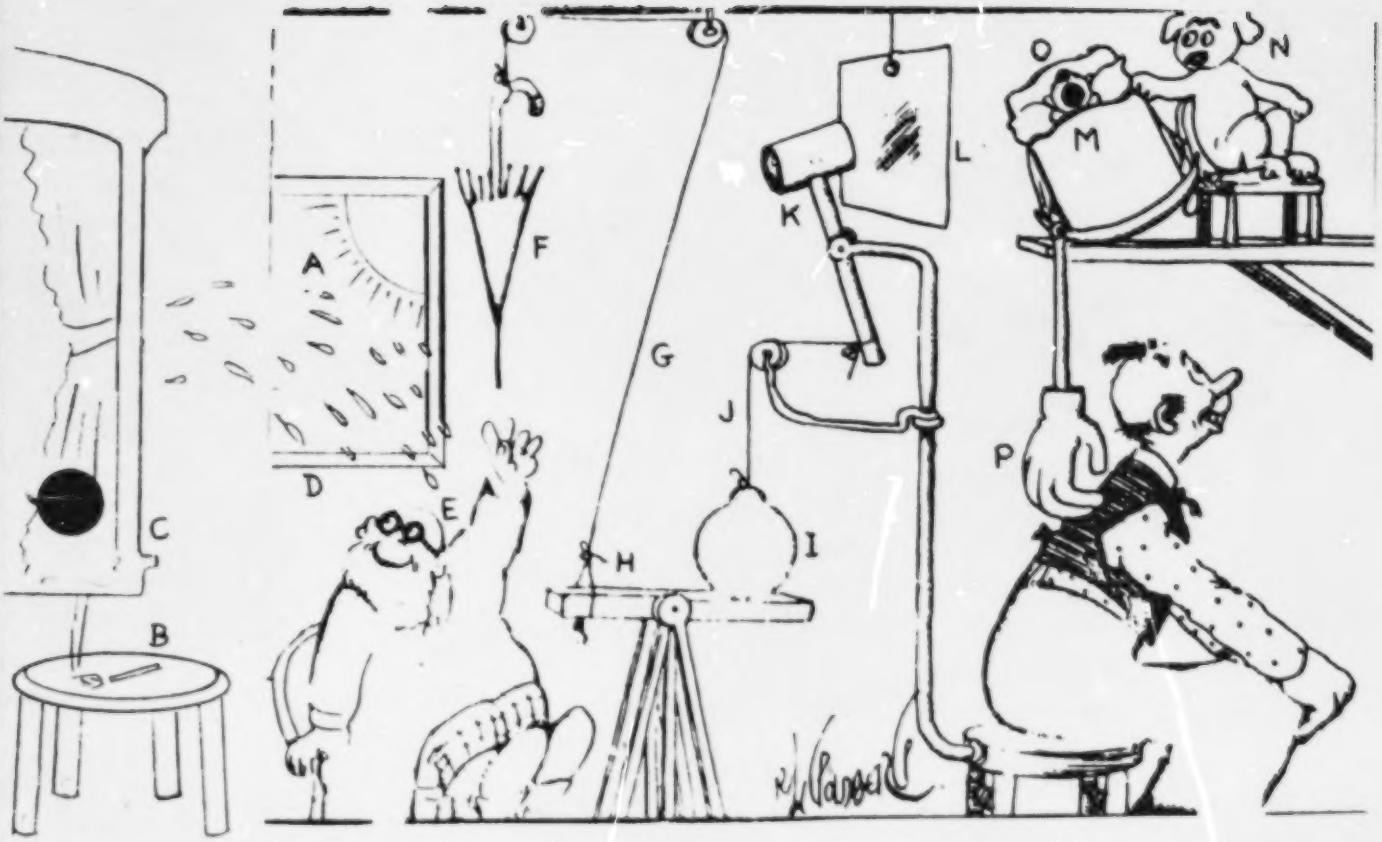
3. Do you think you could patent it and sell it?

FURTHER ACTIVITIES:

Students may wish to build another more complicated Rube-Goldberg machine. Encourage them to do this and bring it into school when completed.

OPTION #2

RUBE-GOLDBERG MACHINE



BACK SCRATCHER

Heat from Sun (A) ignites match (B). Flame from match catches on curtain (C). Fire Department sends water (D) through the window. Man (E) thinks it is raining. He reaches for umbrella (F), pulling string (G) and lifting end of platform (H). Iron ball (I) falls and pulls string (J), causing hammer (K) to hit plate of glass (L). Crash of glass wakes up pup (M). Mother dog (N) rocks him to sleep in cradle (O), causing wooden hand (P) to move up and down along your back.

21

OPTION #3

MATERIALS AND RESOURCES

Wood, 1 ml ethyl alcohol, 1 ml kerosene
FS/C Energy: Where Does It Come From, Forms of Energy, Exploring Matter and Energy, SVE

PROCEDURE:

1. Explain to the students that carbon is the basic chemical in fossil fuels as well as in all living things.

2. Show films or filmstrips on photosynthesis.

3. Explain to the students how coal and oil are formed.

4. Since the key to photosynthesis is the storage of energy, demonstrate how that energy can be released.

5. Burn the wood, kerosene, and alcohol.

DISCUSSION QUESTIONS

1. Where do kerosene and alcohol come from?

2. Is there a limit to our fossil fuels? Why?

3. Why must energy be used to release the stored energy?

4. Does the sun produce any other forms of energy? At this point further topics should be introduced and explored.

   a. Wind and its causes
   b. The ocean currents
   c. Water cycle and water power
   d. Geo-thermal power

BEHAVIORAL OBJECTIVE:

At the completion of this unit the student will be able to explain how energy is lost, mainly as heat, with each transfer of energy within an ecosystem.

SUBJECT AREAS:

Art, Social Studies, Science

KEY WORDS AND DEFINITIONS:

Protein - an essential element in foods to sustain life

Calories - the energy of fuel value of food, or the use of this energy by an organism

OPTION #1

MATERIALS AND RESOURCES

Two (2) packages of yeast
Two (2) large test tubes with one solid stopper and one (1) one-hole stopper
One thermometer that would fit through the hole in the one-hole stopper
Warm water
Sugar
Vaseline

PROCEDURE:

1. Crumble one package of yeast into each test tube.

2. Add enough warm water to fill the test tube three-quarters full.

3. Measure and record the initial temperature.

4. Add one fourth teaspoon sugar to each test tube.

5. Smear vaseline on the solid cork only. Stop up both test tubes firmly but not tightly.

6. Insert the thermometer into the solution through the one-hole stopper and record the temperature every five minutes.

7. As the yeast cells use the sugar, gas and heat are produced. Soon you should notice bubbles of gas forming and a slight temperature increase. As the gas is produced, it presses against the sides of the tube and the cork. As the pressure gets higher, the cork should pop off. The test tube with the thermometer should be insulated with whatever means available to insure the slow production of heat does not get lost before it can be measured.

DISCUSSION QUESTIONS

1. What happened to the solid cork?

2. Was any work performed by the cork? If so, where did the ability to do the work come from?

3. What does this mean in terms of the amount of energy that would be left in the yeast system?

4. What form is at least part of the energy that is being lost? (note your results of test tube with the thermometer)

5. What process is going on while the yeast cells are losing energy?

6. Where do the yeast cells get the energy they need?

7. Does your body go through a similar process; and if so, does it also lose energy during this process?

8. Why do people huddle together on a cold day?

9. Where is energy lost in a food chain as opposed to the energy being transferred?

24

OPTION #2

MATERIALS AND RESOURCES

Energy Expenditure Table, one per student
Calorie Chart

PROCEDURE:

1. Using the energy usage table and the calorie chart, have the students record their input and output of energy for one or more full days.

DISCUSSION QUESTIONS

1. How does your personal energy input compare with your energy output?
2. What might account for any difference?
3. Do you have any evidence that the energy loss is in the form of heat?
4. Can you think of any further experiment that might test your ideas?

OPTION #2

Energy Used by 100# person in Calories per hour

Sewing	10-30
Writing	15
Sitting at rest	10
Standing relaxed	15
Dressing and Undressing	20-30
Ironing	40
Dishwashing	40
Sweeping or dusting	50-85
Polishing	100-150
Housepainting	100-150
Carpentering	100-150
Sawing wood	270-400
Walking 2 mph	130
3 mph	160
4 mph	230
Running	530-670
Bicycling 5 mph	190
10 mph	300
14 mph	470
Horseback riding	
walking	100
trotting	340
galloping	400
Dancing	150-270
Gymnastics	150-340
Playing tennis	270-340
Playing Soccer	350
Wrestling	600-700

Calorie Chart (or inexpensive purchased one)

Meats	Calories
Bacon - slices	95
Beef Roast	210
Hamburger 4 oz.	250
Bologna 1 slice	85
Chicken 3 oz.	180
Frankfurter	155
Ham 3 oz.	290
Lamb lean only 2.5 oz.	140
Pork roast 2.5 oz.	175
Sausage 4 oz.	340
Fish 3 oz.	140
Vegetables (1 cup)	
Baked Beans	320
Beets	70
Broccoli, cabbage carrots, green beans	40
Squash, tomatoes	40
Corn	170
Lima Beans	150
Lettuce - 2 large leaves	5
Potatoes (mashed)	150
Desserts	
Cake 1 slice	180
Chocolate layer	420
Candy - chocolate 1 oz.	145
Doughnuts, plain each	135
Ice Cream 1/2 cup	200
Pie 1 slice	300

Fruits	Calories
Apple-med.	70
sauce	185
Bananas	85
Cantaloupe 1/2	40
Fruit cocktail 1 cup	195
Orange	65
juice (1 cup)	110
Dairy	
Butter 1 square	50
Cheese 1 oz.	100
Cottage Cheese 1 oz.	30
Eggs - each	90
Milk (1 cup)	165
Salad dressings (1 tablespoon)	110
Breads	
Bread 1 slice	60
Cereals 1 cup	105
Macaroni-spaghetti - 1 cup	155
Pancakes 4" each	55
Rice, noodles - 1 cup	200
Miscellaneous	
Carbonated beverages 8 oz.	100
Cocoa	235
Peanuts 1/2 cup	420
Peanut butter 1 tablespoon	90
Pizza 6" wedge	200

26

OPTION #3

MATERIALS

Form A
Overhead projector
Transparency

PROCEDURE: If you have a modern farm or commercial farm nearby, attempt to schedule a visit to see how they save energy.

1. Distribute Form A to the students.
2. Ask the students to fill in the Energy column for each step of the process.
3. Ask them to name as many forms of energy as they can that are needed in each step.
4. Make a transparency of Form A.
5. Have the students compare lists and record some of them on your transparency.
6. The teacher might distribute copies of The Farm Becomes the Factory before discussion begins.

DISCUSSION QUESTIONS

1. We have mentioned the process for beef. Would this process be similar for other farm products?
2. Are there steps that can be changed or eliminated to conserve energy?
3. In any ecosystem is it natural to expend energy? Give examples.
4. When we say it is necessary to expend energy in an ecosystem, what form does this take?
5. Does a lioness hunting for food expend energy? What form does this energy take?
6. Can any form of energy be replaced?

OPTION #3 FORM A

SIRLOIN TIP STEAK	ENERGY USED	ENERGY USED
MEAL PREPARED		
TRAVEL TO RESTAURANT		
PURCHASED IN STORE		
BEEF CUT TO ORDER		
BEEF SHIPPED TO MARKET		
LIVE STEER SLAUGHTERED AND PROCESSED		
LIVE STEER SHIPPED TO MARKET		
LIVE STEER FATTENED		
GRAIN HARVESTED		
GRAIN PLANTED		
SOIL PREPARED FOR FEED		

The Farm Becomes the Factory

Confinement breeding - raising pigs, poultry and cattle indoors and under controlled conditions - is rapidly catching on with farmers and helping them make their farms more business like.

The Bacon Bin is no jerry-built, chicken-wire sort of operation. Rather, it is a building 48' in diameter consisting of corrosion-resistant steel, concrete and plastic-foam insulation, and comes equipped with five automatic fans, a thermostatically controlled heater, hot water pipes and an automatic feeding system. BS&B, a division of International Systems and Controls Corporation, charges $30,000 a unit.

Growing popularity - in the past more farmers would have thought of such an investment as a hoax. But more and more of them are turning to confinement breeding and taking pigs, poultry, and even cattle indoors. At present, over 90 percent of all chickens, 30 percent of all turkeys and nearly 40 percent of all pigs are born and bred under controlled conditions. And although the practice does not yet include cattle on any widespread basis, equipment suppliers like Honeggers' & Company think that by 1972 it may account for twenty percent of all steers raised.

Cattle raising is more expensive. The traditional feedlot of about five acres holds 550 steers and costs around $11,000; a 200' by 60' building equipped to hold the same number runs to $80,000. But, says Jerry Frankl, a vice-president of Iowa Beef Packers, Inc., a big feedlot operator, confinement feeding has to come sooner or later, largely because traditional bedding material in open sheds, used to be free - but now cost Iowa Beef $15,000 to $18,000 a year per feedlot.

Less active indoor life for pigs also makes it easier to put on weight. Indoors, it takes ten percent less feed to add a pound to a porker. The saving is worth about $2 on every 100 pounds of grain - a considerable amount in what livestock manager Frank Hussey, Tilney Farms, a major Minnesota breeder says "as competitive an operation as any in the world".

Under confinement, life is even more regimented for chickens than for pigs. National Mellody Farms, a joint venture of National Tea Company and Hawthorn-Mellody, Inc., quarters 86,000 hens in a four-building egg factory in Libertyville, Illinois. The hens, housed eight to a cage, lay an average of 5,000 dozen eggs daily. These eggs roll onto conveyor belts that automatically move them through washing, cooling, candling, grading, and packing. Once caged, the hens are not touched unless they become ill until they pass their egg-laying prime fifteen months later.

1. Breeding for three pound fryers now takes seven weeks and six pounds of food, whereas it used to take fourteen weeks and twelve pounds of food.

2. This breeding makes these animals unable to survive in a wild situation and tends to make them susceptible to diseases which tend to modify their characteristics.

3. Breeding factories for fryers tend to average 30,000-50,000 per factory. Factories are one large room with automatic food hoppers, water supply, vents and fans for ventilation. Light is regulated on and off for two hour periods.

   After weeks of this, chickens get hostile. For the last four weeks, lights are turned off, blindfolds are put on the chickens and sometimes beaks are removed. Chickens are allowed only one half to three fourths square foot per chicken. Ventilation failure could kill the entire flock.

4. Arsenic, tranquilizers and hormones are administered to relax the chickens and fatten them up. This process leads to Vitamin A & B deficiencies as compared to normally raised chickens.

5. Through hormones, beef cattle is raised in five weeks less time causing thirty five percent less feed to be needed. This process saves the cattle industry ninety million dollars per year.

6. Livestock Protein Conversion Efficiency:

Steer	21.4 pounds of grain	⟶	1 pound of protein
Pig	8 "	" ⟶	
Chicken	5.5 "	" ⟶	
Milk	4.4 "	" ⟶	
Eggs	4.3 "	" ⟶	

   1 acre of cereals ⟶ 5 times as much protein as livestock grazing.
   (Primary calories: The total calories required to produce food)

7. Eighty percent of all grain raised is used for feed. 700,000 tons of high protein fishmeal fed to livestock could feed fifteen million people. We consume ten to twenty percent excess protein. Dogs and cats in the United States consume enough food for eight million people per day.

BEHAVIORAL OBJECTIVE:

At the completion of this unit the student will be able to explain why the amount of energy necessary to maintain an ecosystem is directly related to the amount of stress placed on the system.

SUBJECT AREAS:

Science, Physical Education, Mathematics

KEY WORDS AND DEFINITIONS:

Predator - an animal that kills others for food

Prey - an animal killed by another for food

Stress - a strain placed upon a person or system

OPTION #1

MATERIALS AND RESOURCES

Record player
Can of bad smelling substance
Sticky substance which can be removed easily from the desks (gelatin)
Man's Impact on the Environment, Thomas R. Detwyler, McGraw-Hill, 1971, E^2 Office

PROCEDURE:

1. At the beginning of the school week the students will have five stresses placed upon their classroom environment.

   a. lights out in the room
   b. very loud records, music the student dislike
   c. disagreeable odors
   d. sticky desks
   e. desks placed very close together

2. Students are told that this is their "new" environment and that class will be run as usual except that these five stresses have now been added.

3. At the end of each day, the students can vote to remove any one stress. Thus, if after the first day they vote to spread the desks out, the following day all the other stresses would remain in effect.

4. Let the students remove one stress each day. Keep track of how many students vote for removing each stress.

DISCUSSION QUESTIONS:

1. Did the stresses make you tense, nervous, tired - more so than usual?

2. Is this an indication that you used more energy to combat these symptoms?

3. Why did you vote in the order you did?

4. How did this relate to the environmental problems around us?

5. What did you do personally to try to overcome the stresses?

6. Did the stresses affect your class work? Is this an indication of wasted energy?

OPTION #2

MATERIALS AND RESOURCES

Four different colored toothpicks, equal amount of each color
(Toothpicks can be colored by soaking overnight in food coloring.)
Allow thirty toothpicks per student in the largest class.

Watch with a second hand

PROCEDURE:

1. Before class mark off two areas in the grass of about 30'x60'.

2. In one area place one third of the toothpicks and place the remaining two thirds in the other area. They should be planted in the ground for the most part although some can be strewn on the surface of the grass. Try to avoid clumping them.

3. At the beginning of class, tell the students they are toothpick birds which live off toothpicks. You are going to take them out to a feeding area. They only need ten toothpicks to satisfy their hunger. There are four colors of toothpicks and they like all varieties. When you say "go" they should find ten toothpicks any way they can and report to you. You will be timing the hunt and record the time of each student. The students should also keep track of how many of each color they collected. Inform the students they will only be given ten minutes, regardless, if they get their ten toothpicks. Then, take them to the area with the most toothpicks and begin. When time is up and times and quantities have been recorded, have them replace the toothpicks for the next class adhering to the same rules you did. Warn them early in the game not to break the toothpicks.

4. Now move to the area with the fewest toothpicks. Tell the students the same rules apply. If time allows, give them up to fifteen minutes but still record the time the task took and the number of each color. Again, ready the area for the next class.

DISCUSSION QUESTIONS

1. Were the times faster the first or second time?

2. In the second area, there was a severe limit on food. Did this require you to spend more energy to get a meal?

3. Why is a shortage of food one kind of stress put on a system?

4. Does it make sense to say stresses on a system require more energy?

5. Did colors affect how easily toothpicks were found? What does this imply?

OPTION #3

MATERIALS AND RESOURCES

Graph paper
Stopwatch
Population, Resources, Environment, by Paul and Anne Ehrlich

PROCEDURE:

TEACHER'S NOTE: If space is limited the following changes can be made.

a. The student who is the predator is given three (3) game balls to be used as "bullets".
b. Whenever a ball hits a prey, the prey is captured and must leave the hunting area.
c. If this method is used the discussion should center around the ability of the prey (speed), the ability to throw accurately, etc.
d. The important thing for the instructor to keep in mind is that any size play area can be used and the game can still be effective.

1. Each student takes a turn at being the predator. When a student is not playing the role of the predator, he is the prey.

2. When the teacher says "go", the predator tries to tag as many prey as possible.

3. As soon as a prey has been tagged, he must leave the hunting area.

4. The teacher defines the hunting area at the beginning and all prey must stay in it until they have been tagged. If possible, the number of prey should be exactly known.

5. After a set time period, usually two or three minutes, the teacher yells "stop" and the prey are counted.

6. The predator records the size of the hunting area, the number of prey, the number of prey tagged, and the time to do it.

7. The predator then becomes the prey and a new predator is named.

8. When each student has had a chance, double the size of the hunting area and do it again. You may want to start with half of the gymnasium and then use the full gymnasium. An outside area can also be used.

9. When step 8 has been completed, increase the area another time, possibly a football field or blacktopped area. If time allows, a fourth time. Each time students record their own data and take a turn at being the predator.

10. The students should each make a table and graph of their data as per class discussion. The teacher may also wish to find class averages, etc.

OPTION #3 cont.

11. On paper write a scenario that demonstrates the results of this experiment.

DISCUSSION QUESTIONS

1. How could we best portray the data? What kind of graph would do the best job?

2. What factors, uncontrolled, affected the results? (discussicn of errors) Calculate the number of prey per square feet in each trial.

3. How many did not get their required number of prey in time.

4. Assuming this is the amount of food you need to live, what does that mean happened to you?

5. Is this an example of "survival of the fittest"?

6. By increasing the hunting area and decreasing the number of prey per square foot, you placed a stress on your ecosystem. What was the result? Did you still get your fifty percent?

7. nid it take longer? Did you have to work harder?

8. If this happened in real life, what would happen?

FURTHER ACTIVITIES

The game can be repeated with more than one predator to demonstrate competition and survival of the fittest.

BEHAVIORAL OBJECTIVE:

At the completion of this unit the student will be able to explain how a pollutant affects a natural cycle.

SUBJECT AREAS:

Science, Social Studies

KEY WORDS AND DEFINITIONS:

BOD - (biochemical oxygen demand) - the amount of oxygen used by bacteria to break organic matter in the water

DO - (dissolved oxygen content) - the amount of oxygen actually available in a sampling of water to break down organic matter. This is the reverse of BOD. Thus, as DO declines, BOD rises, then if DO rises, BOD declines.

OPTION #1

MATERIALS AND RESOURCES

Film, Man's Endangered Species, available E^2 Office

PROCEDURE:

1. Discuss what we mean by pollution.
2. Discuss ways man creates pollution.
3. View the film listed above.
4. Discuss man's potential for destruction of nature's systems.
5. Assign each student to find a pollution problem.
6. Discuss problems as they relate to them.

DISCUSSION QUESTIONS:

1. When does something become a pollutant?
2. To what extent can natural systems eliminate waste before it becomes a pollutant?
3. How has man upset the balance of nature?
4. What steps are being taken to relieve our problems?
5. What types of pollution do you find in your community?
6. What can nature do to eliminate problems?
7. What has MAN done or can he do to help eliminate these problems?
8. What do you see for the future of your community as far as pollution problems are concerned?

OPTION #2

MATERIALS AND RESOURCES

Standard equipment for determining BOD and DO HACH hit, available E^2 Office Millipore funnel, filters, nutrient media, petri dishes and plankton net

A curriculum activities guide to water pollution and environmental studies, Tilton School Water Pollution Control Program, Tilton, New Hampshire, 1971

Training Grants Branch, Water Quality Office, Environmental Protection Agency, Washington, D.C. 20242

PROCEDURE:

1. Discuss water pollution as you think it relates to your area. Develop a working knowledge of such terms as oligotrophic, eutrophic, potable water, indicator organism, coliform count, and the like before engaging in project work. A film may be shown to stimulate interest in the topic. NOTE: For junior high students the understanding behind these terms is what is necessary, not the ability to use the words freely as part of their vocabulary.

2. Optional - Take a trip to the school pond and each team of students should collect samples of water. One sample should be taken in a glass bottle with a ground glass stopper to eliminate air and later be tested for the DO content. Another sample should be used for determining the BOD. The third sample should be examined both macroscopically and microscopically for the presence of indicator organisms. This will give you experience in testing water samples.

3. Work in teams and go to various lakes, rivers, or streams and bring three samples of water from each back to the lab. Be certain that air is excluded from one sample and determine the DO content using a suitable method. The second sample can be used to determine the BOD and the third sample can be examined for indicator organisms. Using the millipore funnel technique determine the coliform count.

DISCUSSION QUESTIONS

1. What is polluted water?

2. What assumption can you make about the lakes in our area?

3. Discuss the natural aging process of any body of water.

4. Do pollutants alter the natural processes?

5. In what respects does our sewage treatment plant imitate nature?

6. If sewage treatment plants indeed imitate nature, why can't nature handle the job alone?

7. Were any indicators present in your test site to indicate pollution or lack of pollution?

8. What were the results of your BOD and DO tests? What is the significance of this?

OPTION #2 cont.

FURTHER ACTIVITIES

1. Have the students do a study of the Deep Lake Rejuvenation Program. Some available resources are listed below:

   Case Study of Deep Lake, Lake Villa Township, Lake County News article reprint, "Oxygen Rejuvenates Deep Lake"

   Mr. Douglass Ploss, 356-5944, President, Deep Lake Improvement Assn.

OPTION #3

MATERIALS AND RESOURCES

Any film on smoking and its effects on the body
(Material may be obtained from your local American Cancer Society offices or lung association offices. Information may also be obtained from local physicians.

PROCEDURE:

1. This option is designed to show what happens when an alien substance intrudes into a natural system. As the amount of pollution increases, the system finds it more and more difficult to disperse it. The system referred to in this unit is a combination of the circulatory and respiratory systems in man. Specifically, the unit will show that the human body has considerable difficulty in shaking off the effects of nicotine.

2. Before showing the film*, explain to the students that drugs and smoking can be pollutants of the body and the film is designed to show them that misuse of these has pronounced effects on the human body since the body is not equipped to disperse the pollutant, in this case nicotine, rapidly enough.

DISCUSSION QUESTIONS:

1. What are the effects of smoking on the body?

2. How do the lungs clean themselves of tar?

3. What is nicotine and why is it dangerous?

4. Are there limitations of the body when eliminating pollutants from the system?

5. Why do people smoke?

*If available locally, you could also show Man: The Magnificent Machine.

40